Steering of Solar Sails Using Optical Lift Force

Completed Technology Project (2011 - 2012)

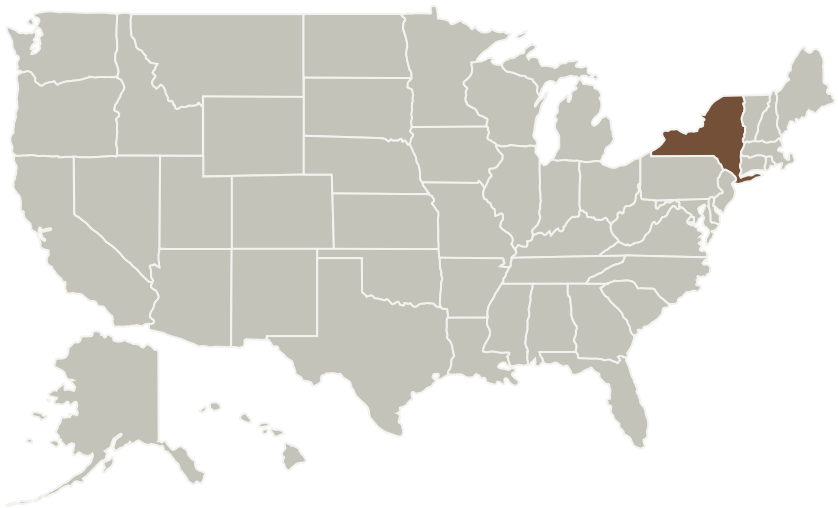
Project Introduction

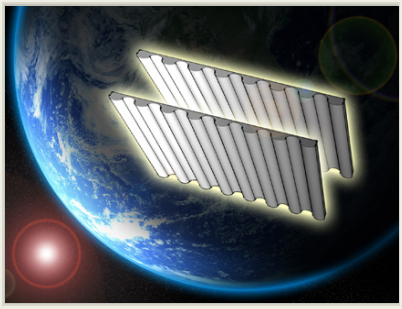
This study seeks to look beyond the use of radiation pressure for thrust, and to explore a means of solar navigation whereby a solar craft would be steered by use of radiation pressure. The idea is based on a recent discovery by the study team. They found that transparent refractive objects may settle into a position where they feel a force that is perpendicular to the incoming light direction. This transverse force is akin to the lift experience by an airplane wing and other airfoils. Thus they call it "optical lift." Objects in their experiments simultaneously thrust forward. The combination of lift and thrust allows for the optical steering of optical wings. In the coming year they will conduct experiments and computer modeling to advance this discovery for future space missions employing solar sails. The long-term goal is to devise a means to allow solar sails to navigate through space using only the power of sunlight. In the short term they will design and fabricate small-scale arrays of optical wings and test them in the laboratory to demonstrate the feasibility of the concept. They will also perform numerical modeling to determine optimal design parameters for optical wings.

Anticipated Benefits

A demonstration of stable control would provide a way for NASA to guide deep space solar sail missions without the need for steering propellants.

Primary U.S. Work Locations and Key Partners





Project Image Steering of Solar Sails Using Optical Lift Force

Table of Contents

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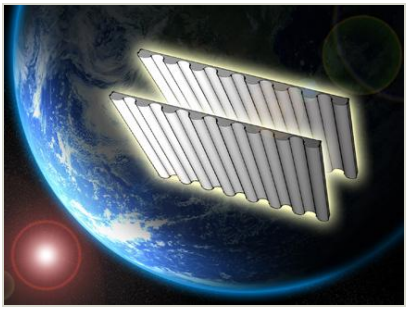
Completed Technology Project (2011 - 2012)

Organizations Performing Work	Role	Type	Location
Rochester Institute of Technology(RIT)	Lead Organization	Academia	Rochester, New York

Primary U.S. Work Locations
New York

Images



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Project Image Steering of Solar Sails Using Optical Lift Force
(https://techport.nasa.gov/image/102316)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Rochester Institute of Technology (RIT)

Responsible Program:
NASA Innovative Advanced Concepts

Project Management

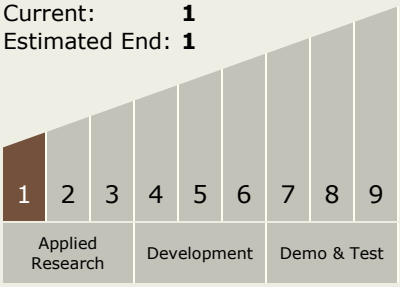
Program Director:
Jason E Derleth

Program Manager:
Eric A Eberly

Principal Investigator:
Grover Swartzlander

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **1**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.4 Advanced Propulsion
    - TX01.4.1 Solar Sails

Target Destinations

Foundational Knowledge, Others Inside the Solar System